Stace and Barrett reply: Our recent work [1] considered a system consisting of a charge qubit coupled to a point contact (PC) charge detector in the relatively unexplored parameter regime, $\Gamma_d \ll \phi$, where Γ_d is the measurement-induced dephasing rate of the detector upon the qubit, and ϕ is the qubit energy splitting. Describing the *conditional* evolution of the system in this parameter regime is particularly interesting in light of recent experiments [2, 3, 4], in which phenomena such as partial localization of an electron in the energy eigenstates of a double well system have been observed. Previous theoretical analyses of the conditional dynamics of this system [5, 6] have been restricted to the limit of large detector voltage bias, $eV \gg \phi$, where, in the steady state, localization does not occur. On the other hand, our analysis is valid for *arbitrary* detector bias, since it properly takes account of qubit relaxation processes due to inelastic tunnelling in the detector.

In [1] we made a number of predictions about the unconditional and conditional dynamics in both the high- ($eV > \phi$) and low-bias ($eV < \phi$) regimes. In their comment, Averin and Korotkov (AK) take issue with just one of these predictions: our claim that coherent oscillations are absent in the detector output (which is contrary to previous claims). AK presume that this discrepancy stems from an assumption "... that the qubit interaction with the PC detector suppresses quantum interference between qubit energy eigenstates.". Furthermore, they assert that the form of our expression for the current (Eq. (9) of [1]), containing three 'jump' operators, follows by assumption.

In fact, we made no such assumptions. Rather Eq. (9) follows naturally from Eq. (5), which is in turn rigourously derived from a microscopic model, as we shall now review. We began by deriving an unconditional master equation (UME). In common with previous analyses of this system [6], we make the Born-Markov approximation, which assumes factorised initial conditions and rapid relaxation of the environment (PC leads). Following this, we make a rotating wave approximation (RWA). The RWA represents an equation for the the lowest order term in a power series expansion of the density matrix, in the perturbative parameter Γ_d/ϕ. This procedure results in a Markovian UME with three Lindblad superoperators.

We proceed to 'unravel' this UME to produce a conditional master equation (CME), capable of describing the dynamics of the qubit conditional upon the stochastic measurement results. The CME must be consistent with the UME, so it follows that the CME has three 'jump' operators, arising from the three Lindblad super-operators. Thus the number of jump processes is *not* an arbitrary assumption, as claimed in the comment, but is a necessary consequence of the UME in the limit $\Gamma_d \ll \phi$, for any finite value of the ratio eV/ϕ. In [1] the particular form of our jump operators is determined by physical considerations, such as energy conservation, but they can also be derived directly from an explicit model of the measurement process (see Ref. [7]).

In the low bias regime, $eV < \phi$, the UME predicts that the qubit relaxes to the (pure) ground state, $|g\rangle$. Since $|g\rangle$ is stationary, there should be no oscillatory signal in the PC current, and no peaks in $S_{\mathrm{lb}}(\omega)$ should be seen at $\omega = \phi$, in agreement with [8].

Although the specific objections raised by AK are unfounded, we note that in the high-bias regime, $eV > \phi$, there may be a problem in interpreting our power spectra at high frequencies. In making the RWA to arrive at the UME, we have ignored fast dynamics on time scales $\sim \phi^{-1}$. In [7] this temporal 'coarse-graining' is made evident by deriving the jump operators using an explicit current measurement model in which PC tunnelling events are counted. Therefore, although our expression for $S_{\mathrm{hb}}(\omega)$ is correct for $\omega \ll \phi$, it may not apply at frequencies comparable to ϕ, in the high-bias regime.

In summary, we now believe that our assertion in [1], that coherent oscillations in the detector output are suppressed, may only be justified in the low-bias regime, $eV < \phi$. In the high-bias regime, $eV > \phi$, we are unable to make firm predictions about such high-frequency oscillations, since our Markovian description only strictly applies for timescales longer than ϕ^{-1}. The remainder of our conclusions are valid. Furthermore, our approach provides an accurate description of continuous measurement in experimentally accessible parameter regimes, and will serve as a basis for future theoretical work.

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